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DESCRIPTIVE OUTLINE.

THE main features of this new system of constructing Railroads are so clearly shown by the accompanying Plates that perhaps no further comment is necessary save a brief statement of the very great advantages to be secured by its adoption. It is, however, chiefly in new countries hitherto unprovided with Railroads, and in agricultural districts which are too thinly populated, or from other causes are unable to afford the heavy preliminary expenses of Railroads as ordinarily constructed, where the Post and Rail-Way system will be found most advantageous and useful.

The low cost of construction combined with the indestructibility of the permanent way, which is elevated above ground clear of the destructive effects of soil saturated with moisture, renders the Post and Rail-Way system superior to any type of Railroad constructed with a formation level, and laid on ballast, constantly being eroded by rains, and as constantly requiring renewal and repacking.

Again, the necessity of levelling formation is completely avoided by the new system: banks and cuttings, together with culverts and side drains, are at once rendered unnecessary, whilst roads and rivers are crossed astride a single girder.

It is so clearly advantageous to leave the natural drainage of the country traversed by a line of railway unaltered that further argument on this head is not required, and it is only necessary to point out that the posts can be most readily adjusted in height to suit the undulations of the ground, which with a properly selected line across country, perhaps almost as direct as a public road, will leave the land drainage untouched. The "grip" given to the upper and under driving wheels of the locomotive enables the engineer of the line to select a route whereon gradients of 1 in 10 may be safely and practically entertained. Again, from the narrowness of the gauge permitting the employment of curves of 100 feet radius, it is clear that the Post and Rail-Way system stands on no ordinary footing in relation to the many minor projects that have been proposed or carried out, to lessen the enormous initial cost of Railroads constructed on the ordinary plan.

In arranging the component parts of the system, the whole Rolling Stock must be divided longitudinally and vertically into halves, and separated by a small space, in order to allow the posts and tops of the rails to stand at or above the centre of gravity of the carriages, whereby the stabilty of the whole Rolling Stock is rendered much greater than when perched high above rails laid on the ground, and consequently a proportionately narrower wheel base can be safely used, rendering it advantageous to connect the rails together transversely by ties, so that they become one long continuous girder, due allowances being made at alternating intervals for expansion and contraction.

By employing steel rails a large saving can be again ensured, inasmuch as the pitch or spans between the posts can be safely increased. The "grip" given to the upper and under driving wheels of the locomotive avoids subjecting the rails to the crushing weights necessary in order to obtain adhesion with ordinary locomotives. This latter consideration is a most important one, and deserves great attention in estimating between the old and new systems. In fact the weights can now be so fairly distributed on the rails and posts that the locomotive will pass over the weighing machine as lightly as one of the carriages.

The addition of small check wheels hanging from the axles of the upper wheels of the whole Rolling Stock prevents the possibility of the train leaving the line, and the construction of the carriages themselves would prevent any great misfortune even were one or both of the rails to break down under them as they pass: the longitudinal plates connecting each half of the carriages would, whilst deriving lateral support from their connections with the other carriages, simply skid over the gap like a sleigh, until the danger was passed. These check wheels under the rails also serve the double purpose of preventing undue oscillation of the carriages at high speeds, but will not retard their velocity in the slightest, inasmuch as they come in contact only when the conditions require it, and hang just clear of the under sides of rails when the carriage is at rest.

The posts may either be of timber, creosoted or not, or of cast or wrought iron, in the form of short screw piles, with large screws, adapted to spread the pressures over a sufficient quantity of the surface soil. At certain localities, and over rocky ground, the posts may be alternated with brick, stone, or concrete piers, and at curves, or near precipices, dwarf-walling or combinations of any of the foregoing may be used, as is found most practicable and useful. The posts can also be inclined to the vertical slightly at curves, in order to give the requisite amount of "cant," and when greater lateral rigidity is required in loose or boggy soils the screws can alternately incline slightly on the one side or the other.

In the event of cast or wrought iron posts being used, the chairs for bearing the rails as shown in the drawings may be cast elliptical on plan, thereby allowing for any irregularity or want of perpendicularity in the line of posts; and in order to fix the chairs in their exact places at the least expense of time and money, the annular space between the chair and around head of post may be run in with an alloy of lead and tin, cheapened by being liberally mixed with small cast-iron shot, which will simply float in the melting pot, and be ladled out proportionately when wanted, when the rails are in due form and line, and have been previously wedged in their places for that purpose. The insides of the chairs and heads of posts are milled to cause the alloy to bond them together immovably.

It is clear that the power of adjustment afforded by such a rapid mode of fixing the posts and rails gives great facilities of erection in new countries where skilled labour is difficult to obtain, and again the fixity of tenure afforded by the process just indicated gives increased lateral rigidity to the whole system, and at once avoids many of the current items of expense for renewals and repackings of the ordinary permanent way.

The alternate continuity of the rails also gives a far higher ratio of strength to the several structures in series, both laterally and vertically, and the chairs at tops of posts being **T**-formed longitudinally to a certain extent, and as far as economically practicable, give even more strength by materially decreasing the length of the spans and removing the points of contrary flexure in the rails closer together, relatively to the diminished span.

The posts can be pitched or spaced apart at such convenient distances as may be found most suitable or economical to the nature of the soil; but at points and crossings special appliances are necessary, and a short length of posts and rails made moveable radially and laterally upon wheels, and over short lengths of common rail laid transversely on the ground.

Many combinations of the foregoing general conditions will occur to everyone requiring cheap Railroads, and numerous adaptations and alterations have been designed to meet special exigencies—in fact so numerous are they that it will not be possible to mention all. The principal variety is, however, the lattice girder form of line, with steel rails at four corners, each side of which can be turned as rolling faces, and would be specially useful at road-crossings or other places requiring large spans, if supplemented with cylinder piers perhaps, instead of ordinary posts.

The Rolling Stock can either be constructed with longitudinal or transverse compartments, but the former is far preferable as it gives facilities for ticket collection and interchange of passengers in over-crowded carriages, with a means of communication between guard and engine driver, and other minor advantages not possessed by the transverse plan. The centre of gravity being so much below the wheel base in the Post and Rail-

Way system, it becomes indifferent whether the Rolling Stock is equally loaded on either side of the rails or not, especially as the under check-wheels prevent the possibility of any contigency arising from this cause; it is however quite within the province of the guard to dispose his passengers in equal proportions upon either side of the carriage, and facilities are afforded for this purpose by the steps at each end of the same.

The freight wagons are constructed on precisely the same general principles as the passenger carriages, and can either be covered or open as required ; they present, however, unusual facilities for unloading, if hatches are provided in their floors, for lowering certain kinds of freight into trucks or carts passing underneath them and between the posts. And again, for the greater facility of intercommunication between branch Post and Rail-Ways and ordinary gauged lines, and in order to avoid "breaking bulk" with heavy freight, it is perfectly practicable to supplement wheels of any required gauge to the bases of the wagons, whereby they can run off the Post and Rail-Way and on to ordinary lines.

The Locomotive shown in Plate 2 presents special features and advantages so important that it will evidently be a great improvement upon the ordinary type, especially so in avoiding the heavy crushing strains necessary to obtain adhesion by sheer weight. The simple arrangement shown in the drawings, whereby the engine driver can rapidly and easily press the upper and under driving-wheels, together, with any required strain on both surfaces, leaves little to be desired. By turning the hand-wheel attached to the lower ends of the coupling links, whereby the under-wheels are moved radially from the upper wheels, the vertical distance between their centres is consequently shortened, in doing which, and in the manner described, a powerful leverage is obtained, in the simplest and most inexpensive way.

When the engine is not heavily loaded, or on level or descending gradients, the "grip" can be thrown out of gear instantaneously, and will then merely hang from the upper driving-wheel axles, and remain perfectly at rest.

The same simple mechanism is adapted to the break-gear, where under steel skids take the place of the under wheels. When these skids are moved from links also hanging radially from the leading wheels of the Locomotive, and in the same manner, and by perfectly similar means, as before described, (except that the skid hand-wheels are connected to a transverse worm-wheel shaft in order that the skidding on either rail should act together,) then the leverage of the break power, whilst pressing on the rails only, will bring the train to a stand in the smallest possible interval, and with the least wear and tear of wheel tires or rails.

The leading carrying-wheels are connected together compactly into one strong bogie pivot, which has also a lateral movement of two inches or so in the guide-frames, which is given for the purpose of allowing the engine to run round 100-ft. curves, by practically diminishing the wheel base to the length of the coupled driving-wheel centres. Over the bogie pivot, and near the two vertical boilers which hang on either side thereof, the cylinders and slide-valve chests are placed, whereby the steam has the shortest and most direct passage to and fro, by which a sharp blast is insured, and undue condensation of steam in the ports and pipes avoided. Inside coupling eccentrics may be used in lieu of outside coupling rods, pins, straps, and brasses. These eccentrics also being in direct line with the slide-valve chests, naturally fall in for the link-motion gear. Generally, however, the engines are in complete duplicate, and work perfectly independent of each other, so that it would be possible to drive each separately if required. The readiest access to all the working parts is obtained in this construction, and the weights are so distributed by the counterbalancing water and coal tanks, which, together with the boilers, hang pannier-like on either sides of the posts and rails, that in no case is it necessary to put more crushing weight upon any one wheel than is desirable, both for wear of permanent way and wheel-tires. The coupling-chains, and right and left-handed screw couplings to carriages, are supplemented with one central buffer, consisting of an arc, with radius of half the length of carriage, upon which a thick strip of vulcanised indiarubber is secured, and which takes the place of the ordinary volute-springed buffers.

To recapitulate.—The claims of the Post and Rail-Way system are briefly as follows:

The centre of gravity of the whole Rolling Stock is greatly lowered, as compared with that in use on ordinary railroads, whereby a considerably narrower gauge of rails is rendered both practicable and desirable, whilst at the same time a great reduction in the constructional cost and maintenance of the railroad is effected. Moreover, in respect of original cost of the Post and Rail-Way system, the ground simply requires clearing in most cases, to be ready for use.

As rain or land-drainage cannot affect the permanent way, no ballast being necessary, the cost of maintenance is reduced most considerably, whilst culverts and side-drains are dispensed with altogether, and the natural drainage of the country traversed is not interfered with. Very sharp curves also are permissible from the narrowness of the gauge, consequently rendering it easy to contour round spurs and valleys, thus avoiding banks and cuttings.

The steepest gradients also are permissible with the press grip given by the Locomotive, and the gradients of most of the roads crossed can be left unaltered by simply increasing the height of the posts in their immediate vicinity. Obstructions on, and running off the line, are practically prevented. Root and other crops can be grown round the posts and on the inclosed railway land, which can be tilled most advantageously in suitable soils, by means of ploughs dragged by locomotives during the intervals of ordinary traffic, which in agricultural lines are often long. Snowing up the line is nearly rendered impossible, even in mountain passes, under all ordinary conditions. Telegraph wires can be slung from the railway posts themselves, and finally the ticket collection is considerably facilitated by the free passage afforded from one end of the train to the other, either through the carriages, or over the rails down the central space.

The advantages of the Post and Rail-Way system in rapidity and simplicity of construction are perhaps the most important of all, and it can be readily seen how rapidly the line would advance over the face of the country when systematic operations are organised, and the posts driven, pitched, or screwed into their places by simple mechanical appliances, the rails immediately following them up, so that fresh materials may be brought as required right on to the scene of operations.

With proper organisation and appliances there is nothing to prevent a line on this system from being constructed at the rate of a mile per day, and thus the capital employed becomes immediately productive.

The cost of a mile of first-class single line of way with steel rails and creosoted timber piles 15 feet apart, including all ordinary bridging, but without stations, land, exceptional works of art, or rolling stock, will be 2,790*l.* If with cast-iron screw piles 10 inches diameter, and 15 feet apart, with steel rails to carry 1 ton per foot run, the cost will be 3,000*l.* per mile, estimated at the ordinary prices now quoted in England.

Railway directors, landowners, contractors, and others interested in railway extension by cheap and legitimate means, calculated to insure remunerative investment of capital, can obtain licences and all other information, either from the inventor and patentee, or from the co-proprietor of the patent, James Samuel, Esq., Mem. Inst. C.E., 26, Great George Street, Westminster, S.W., where working models can be also seen, and preliminary negociations arranged.

H. Temple Humphreys, Mem. Inst. C.E.,
Co. Surveyor, Limerick.